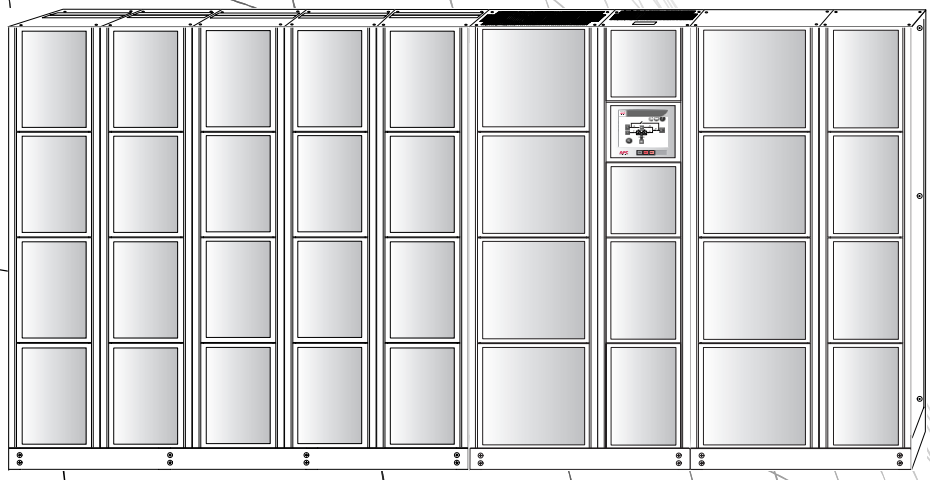
www.apc.com

# Installation

## Symmetra® MW

**1000 kW**
**480 V**



# Contents


## Safety ..... 1

### IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS ..... 1

Symbols used in this guide ..... 1

Installation safety ..... 2

## System Overview ..... 3

### UPS Sections ..... 3

Serial number ..... 3

Inverter Section ..... 3

Control Section ..... 3

Input/Output Section ..... 3

### Configurations ..... 4

Configuration 1 (Inverter Section placed to the left) ..... 4

Configuration 2 (Inverter Section placed to the right) ..... 5

### External Bypass Static Switch. ..... 6

Serial number ..... 6

## Electrical Installation ..... 7

### Typical UPS Wiring Principle ..... 7

Power wiring overview ..... 7

External disconnection switches ..... 8

Input/Output wiring precautions ..... 8

### Top Cable Entry. ..... 9

Preparing for top cable entry (default) ..... 9

Battery cable connections (top cable entry) ..... 10

Ground and AC cable connections (top cable entry) ..... 12

Bottom Cable Entry . . . . . 13
Preparing for bottom cable entry . . . . . 13
Battery cable connections (bottom cable entry) . . . . . 15
Ground and AC cable connections (bottom cable entry) . . . . 17
Bypass Static Switch Wiring . . . . . 18
Top cable entry . . . . . 19
Bottom cable entry . . . . . 20
Communication cable overview . . . . . 21
Relay Board (Optional) . . . . . 22
Location of optional Relay Board . . . . . 22
Communication cables with optional Relay Board . . . . . 23
Relay Board functions . . . . . 24
Specifications ..... 27
Low-Impedance/High-Impedance Grounding . . . . . 27
Low-impedance grounding . . . . . 27
High-impedance grounding . . . . . 27
Electrical Specification . . . . . 29
Installation Planning Data . . . . . 29
AC Input . . . . . 30
DC Input . . . . . 30
AC Output . . . . . 31
AC Input External Bypass SSW . . . . . 31
Heat Dissipation . . . . . 31
Notes . . . . . 31
Table 2 - Table 310-16 (National Electrical Code) . . . . . 32
Recommended cable, bolt, and lug sizes . . . . . 34
Torque specifications . . . . . 34
Required Breaker Settings . . . . . 35
Input and upstream breakers — minimum settings . . . . . 35
Output and downstream breakers — minimum settings . . . . 35
General Specifications 480 V . . . . . 37

# Safety

## IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

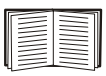
This guide contains important instructions for SYMF1000KG that should be followed when handling the UPS, External Bypass Static Switch, Battery Enclosures, and Batteries.

### Symbols used in this guide

**WARNING!**
**Indicates an electrical hazard, which, if not avoided, could result in injury or death.**

**CAUTION!**
Indicates a hazard, which, if not avoided, could result in injury or death.

Indicates important information.



Indicates that more information is available on this subject in a different section of this manual.

Indicates that more information is available on the same subject in a different manual.

Main Protective Earthing Terminal symbol.

Ground symbol.

## Installation safety

**EPO**

Press the EPO (Emergency Power Off) button to switch off all AC and DC power supply to connected equipment in the room. The EPO is typically located on a wall in the room in which the UPS is installed. See “Communication cable overview” section for information on how to wire the UPS to the EPO.

**WARNING!**
**Before starting installation, check and test that all AC and DC power source breakers are in open position.**

**WARNING!**
**Only personnel trained in the construction and operation of the equipment, and the electrical and mechanical hazards involved, may install or remove system components.**

**CAUTION!**
Do not use High Voltage Testing Equipment. This equipement will destroy the electronic circuits in the unit.

**CAUTION!**
The system is equipped with an optional auto-start function, enabling the system to start without any warning when power is applied.

**CAUTION!**
All wiring must be in accordance with applicable national and/or local electrical codes.

This unit contains components that are sensitive to electrostatic discharge (ESD). Follow proper ESD procedures to avoid severe damage to electronic components.

Note

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the Installation Manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

# System Overview

## UPS Sections

The UPS system consists of an 1000 kW Inverter Section, a Control Section, an Input/Output Section and an External Bypass Static Switch Section.

### Serial number

The serial number is stated on the type label behind the finishing panel above the display unit. Remove finishing panel to see serial number.

### Inverter Section

The Inverter Section regulates the UPS output and operates from battery power in the event of utility input loss.

### Control Section

The Control Section controls and monitors the UPS and the Main Static Switch (incorporated in the Control Section).

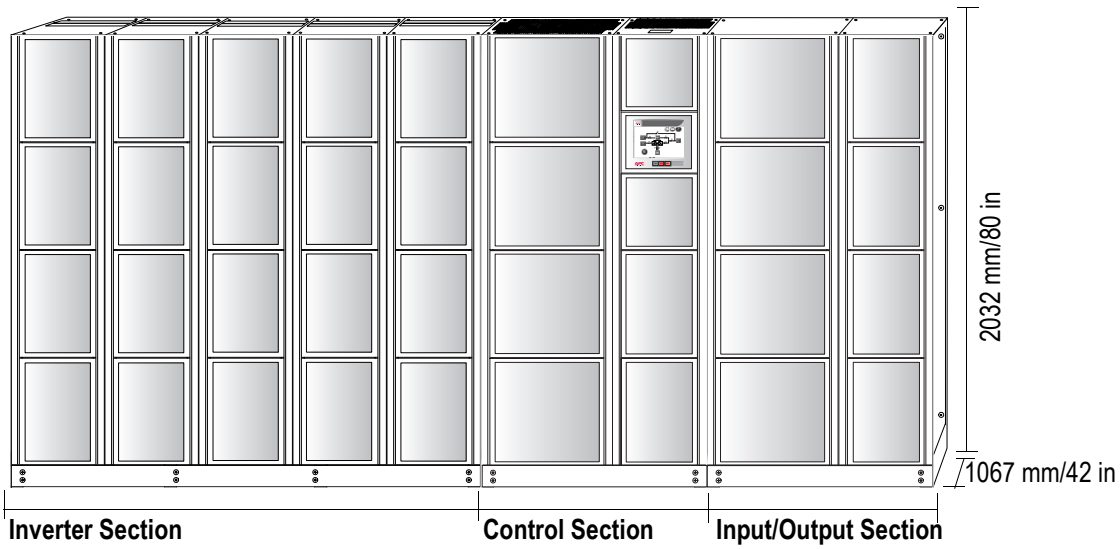
### Input/Output Section

The Input/Output Section provides electrical connection of input and output.

# Configurations

The UPS system can be configured in two ways. The Inverter Section can be placed either to the left or to the right of the Control Section. The two configurations are shown below.

### Configuration 1 (Inverter Section placed to the left)




**Inverter Section**

**Width:**
2112 mm/83.15 in

**Control Section**

**Width:**
1012 mm/39.84 in

**Input/Output Section**

**Width:**
1014 mm/39.92 in

**Total width of UPS sections:**
4138 mm/163 in

**Weight:**
Without Power Modules: 4197 kg/9233 lb
With Power Modules: 5049 kg/11108 lb

## Configuration 2 (Inverter Section placed to the right)

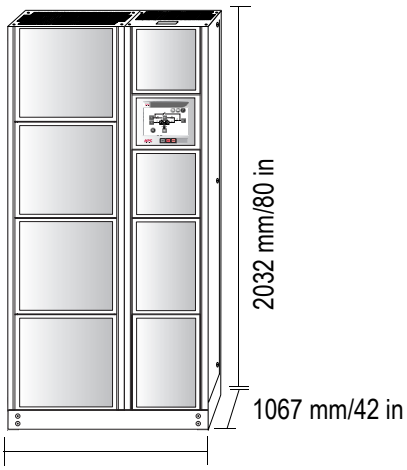
| Input/Output Section | Control Section | Inverter Section |
|---|---|---|
| **Width:**<br>1014 mm/39.92 in | **Width:**<br>1012 mm/39.84 in | **Width:**<br>2112 mm/83.15 in |

**Total width of UPS sections:**
4138 mm/163 in

**Weight:**
Without Power Modules: 4197 kg/9233 lb
With Power Modules: 5049 kg/11108 lb

# External Bypass Static Switch

The External Bypass Static Switch (External Bypass SSW) transfers the load (manually or automatically) from the UPS to an alternate source without interrupting the power to the load.




**External Bypass Static Switch**

**Width:**
1014 mm/39.82 in

**Weight:**
460 kg/1012 lb

### Serial number

The serial number is stated on the type label behind the finishing panel above the display unit. Remove finishing panel to see serial number.

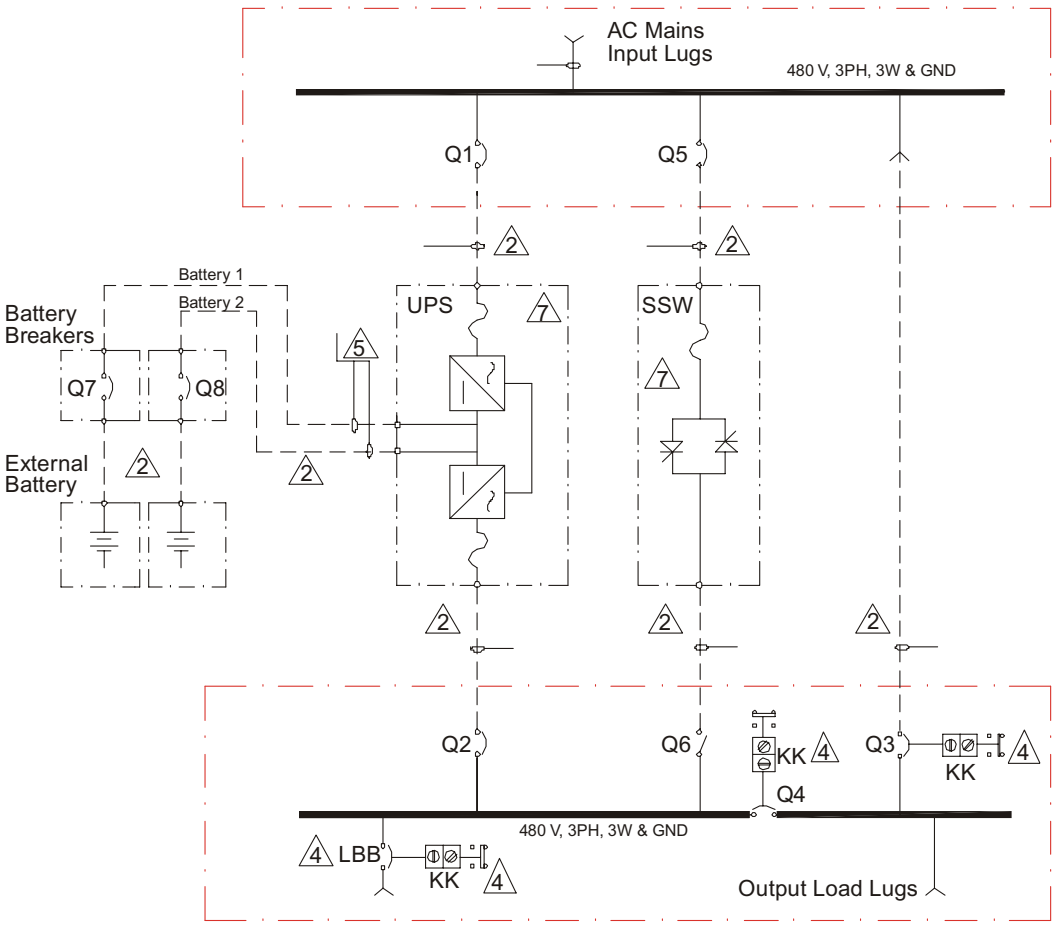
# Electrical Installation

## Typical UPS Wiring Principle

### Power wiring overview

See also

See separate guide on parallel operation for wiring overview in parallel systems.




NOTES:

1. SOURCE AND AC CABLING MUST BE 480 VOLT, WYE CONNECTED, 3 PHASE, 3 WIRE + GROUND (CONTACT APC IF OTHER).
2. △ DASHED LINES BETWEEN UNITS ( — — — ) REPRESENT AC/DC CABLING PROVIDED BY OTHERS.
3. ALL AC CIRCUIT BREAKERS ARE 100% CONTINUOUS DUTY RATED WITH 24 VOLT DC SHUNT TRIPS AND 2A/2B AUXILIARY CONTACTS.
4. △ OPTIONAL COMPONENTS
5. △ SEPARATE CONDUITS. TWO WIRE + GROUND
6. UPS INPUT AND OUTPUT CONDUCTORS MUST BE IN SEPARATE AMPERE RATINGS.
7. △ UPS AND STATIC BYPASS WITHSTAND 200,000 SYMMETRICAL AMPERES.
8. INSTALLATION MUST COMPLY WITH ALL APPLICABLE NATIONAL AND LOCAL CODES.

## External disconnection switches

**WARNING!**
**The UPS has no internal manual disconnect devices to switch off external AC (Q1 and Q5) and DC (Q7 and Q8) input power. Ensure that disconnection devices are available as separate components for this installation.**

The installer must provide each external disconnection device for this UPS system with labels displaying the following text:
"Isolate the Uninterruptible Power Supply (UPS) as instructed in the User Guide before working on circuit."

## Input/Output wiring precautions

**WARNING!**
**Only personnel trained in the construction and operation of the equipment, and the electrical and mechanical hazards involved, may install or remove system components.**

**WARNING!**
**Supply the UPS from a dedicated, grounded, 3-wire Wye service.**

**CAUTION!**
All wiring must be in accordance with applicable national and/or local electrical codes.

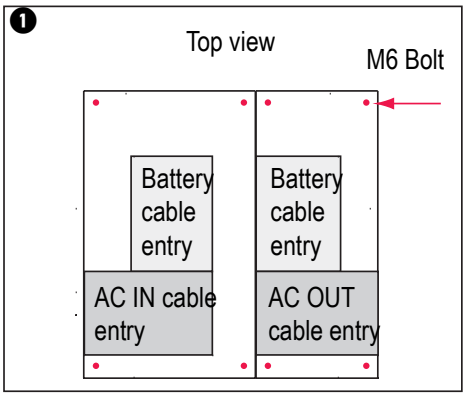
Use only UL-approved cable lugs.

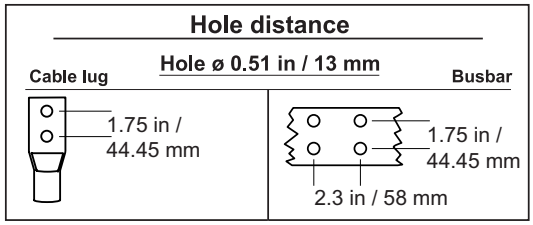
Use only UL-approved cables. Use only stranded copper conductors. Refer to National Electric Code for wiring and protection. Refer to bolt and lug table in the "Specifications" section.

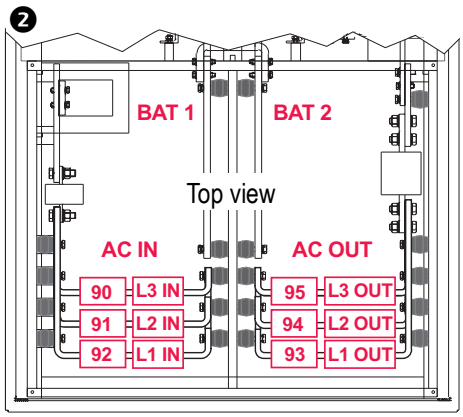
# Top Cable Entry

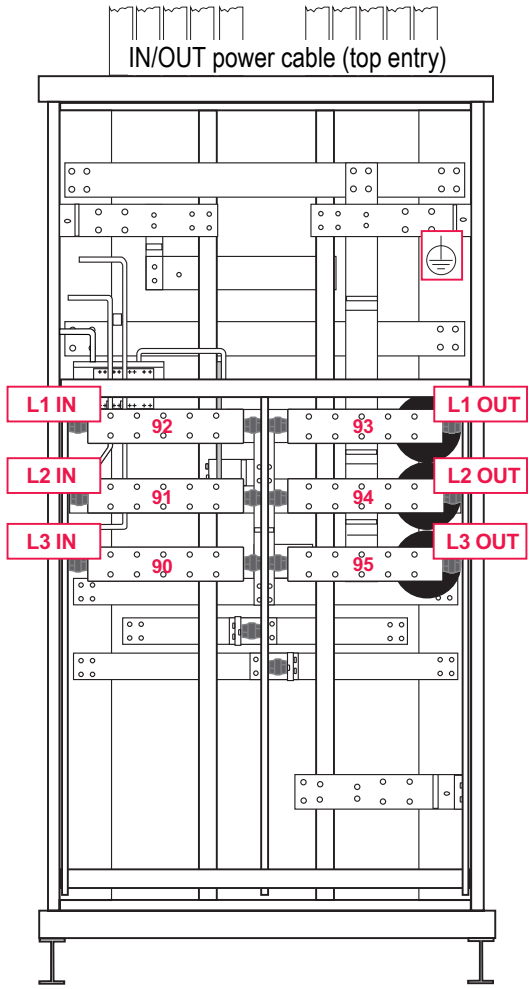
## Preparing for top cable entry (default)

Cable entry in top cover of Input/Output Section.




❶ Loosen the 8 bolts in cable entry covers. Drill holes for conduits in areas shown. Re-fit the covers and install the conduits.

❷ Install cable lugs on busbars. Use M12 bolts.

## Battery cable connections (top cable entry)

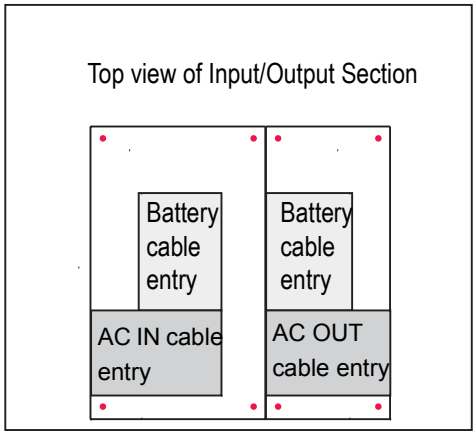
**WARNING!**
**Make sure that the battery breakers are open (OFF) prior to running the cables.**

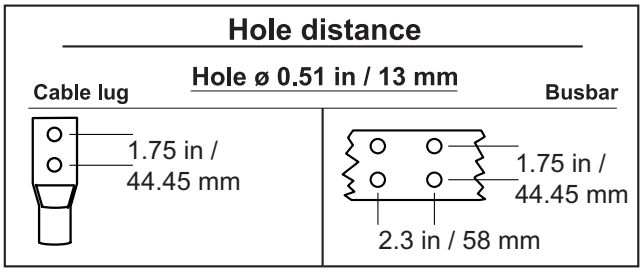
**CAUTION!**
Refer to the battery manufacturer's installation manual.

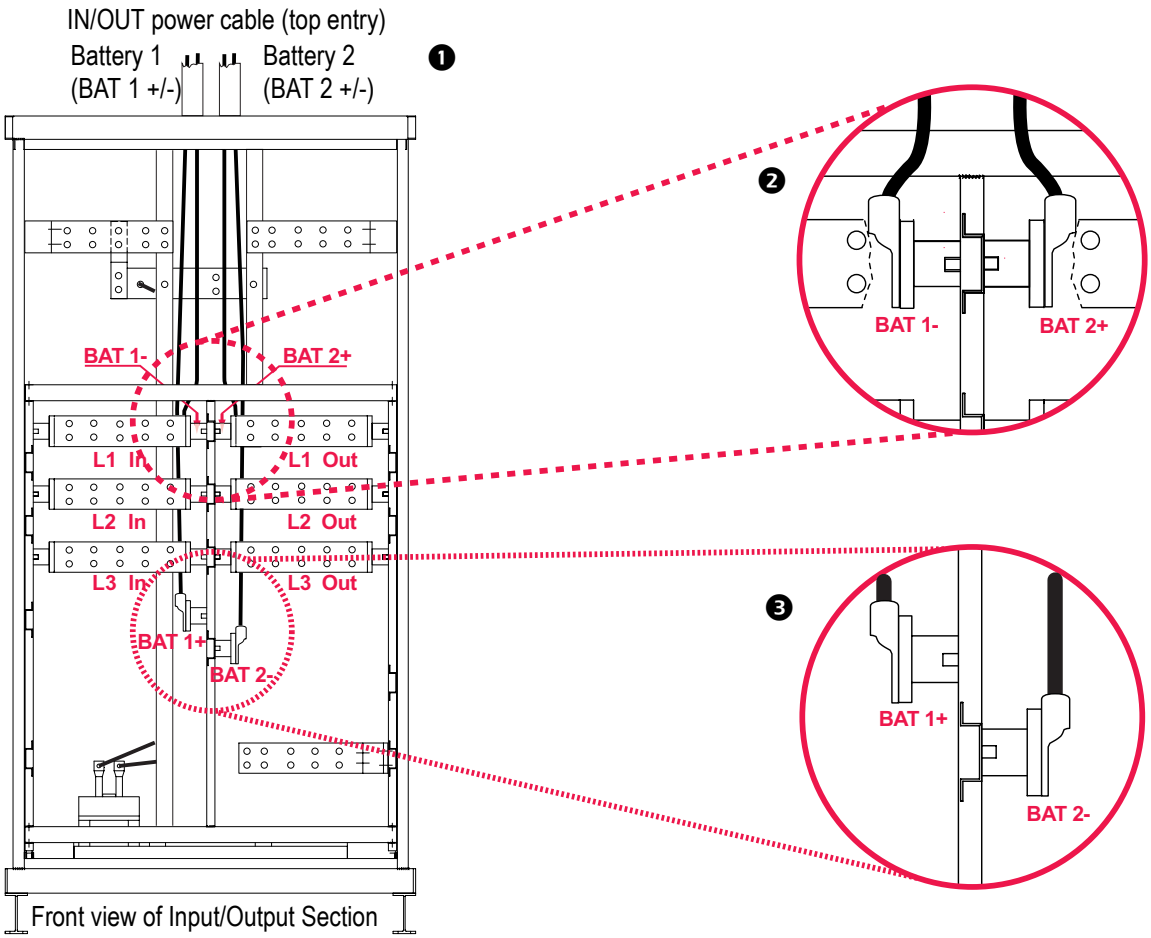
**CAUTION!**
The minimum DC voltage rating of the battery supply over-current protective device is 500 V.

Over-current protection for the battery circuit is required by code.

BAT 1 and BAT 2 cables MUST be run in separate conduits.



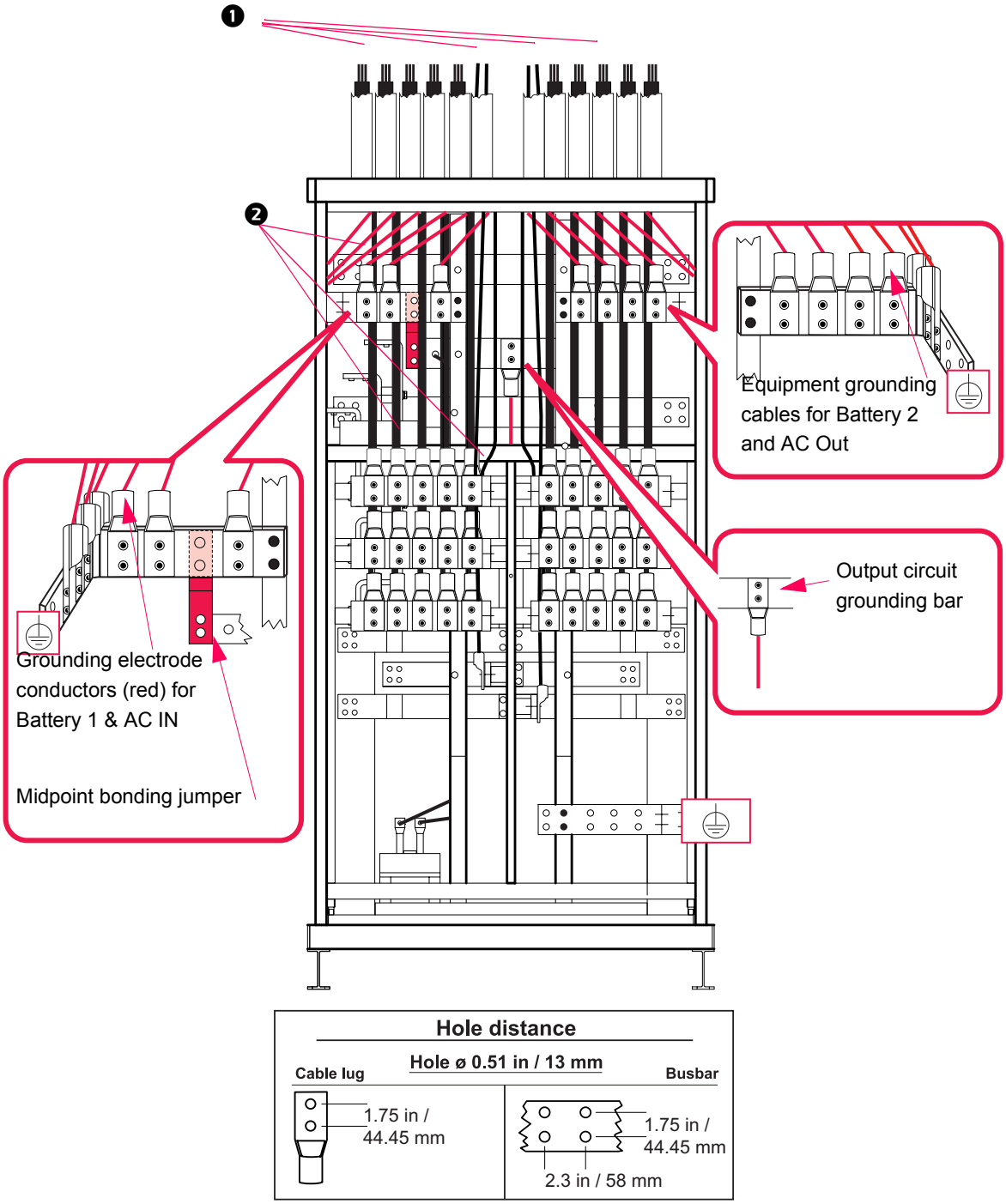




❶ Feed the battery cables through the top of Input/Output Section.

❷ Connect cables from battery system as illustrated.

❸ Connect cables from battery system as illustrated.

## Ground and AC cable connections (top cable entry)

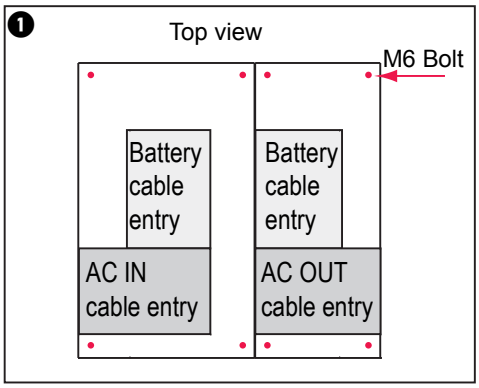


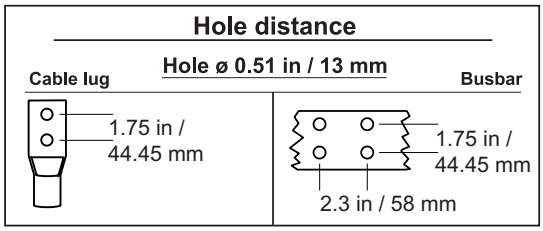

1. Feed the AC and ground cables through the top of Input/Output Section as illustrated.
2. Connect the cables as illustrated.

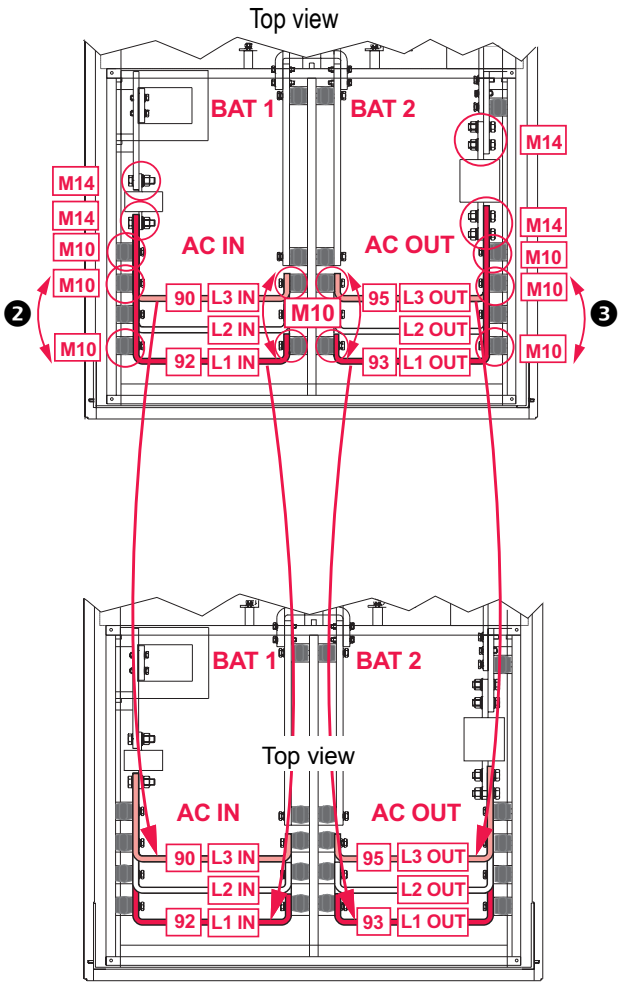
# Bottom Cable Entry

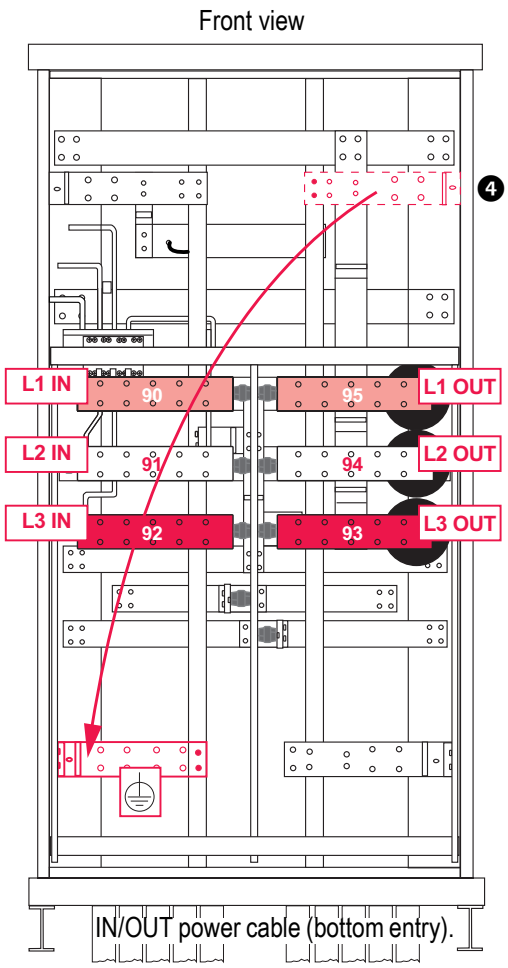
## Preparing for bottom cable entry

Cable entry in bottom cover of Input/Output Section



❶ Preparation for bottom cable entry

a. Loosen bolts of both cable entry covers and remove.

b. Drill holes for conduits for AC, Battery, and Output circuit grounding electrode cable in areas shown.

c. Install conduits.

d. Remount covers.

❷ Interchange of AC IN busbars for bottom entry

a. Remove nuts from M14 bolts at busbars 90 and 92.

b. Remove bolt, washer and fuse.

c. Remove bolts from M10 at busbars 90 and 92.

d. Remove busbars 90 and 92 at AC IN.

e. Move the two front insulators in the topmost busbar position two stud positions to the front.

f. Move the two front insulators in the lowest busbar position two stud positions to the rear.

g. Install busbar 90 in original position of busbar 92.

h. Install busbar 92 in original position of busbar 90.

i. Reattach bolts at busbars 90 and 92.

j. Install cable lugs on busbars using M12 bolts.

❸ Interchange of AC OUT busbars for bottom entry

a. Remove nuts from M14 bolts at busbars 93 and 95.

b. Remove bolt, washer and fuse.

c. Remove bolts from M10 at busbars 93 and 95.

d. Remove busbars 93 and 95 at AC OUT.

e. Move the two front insulators in the topmost busbar position two stud positions to the front.

f. Move the two front insulators in the lowest busbar position two stud positions to the rear.

g. Install busbar 93 in original position of busbar 95.

h. Install busbar 95 in original position of busbar 93.

i. Reattach bolts at busbars 93 and 95.

j. Install cable lugs on busbars using M12 bolts.

❹ Moving busbar for grounding

a. Move busbar for grounding from upper right corner to lower left corner as illustrated.

## Battery cable connections (bottom cable entry)

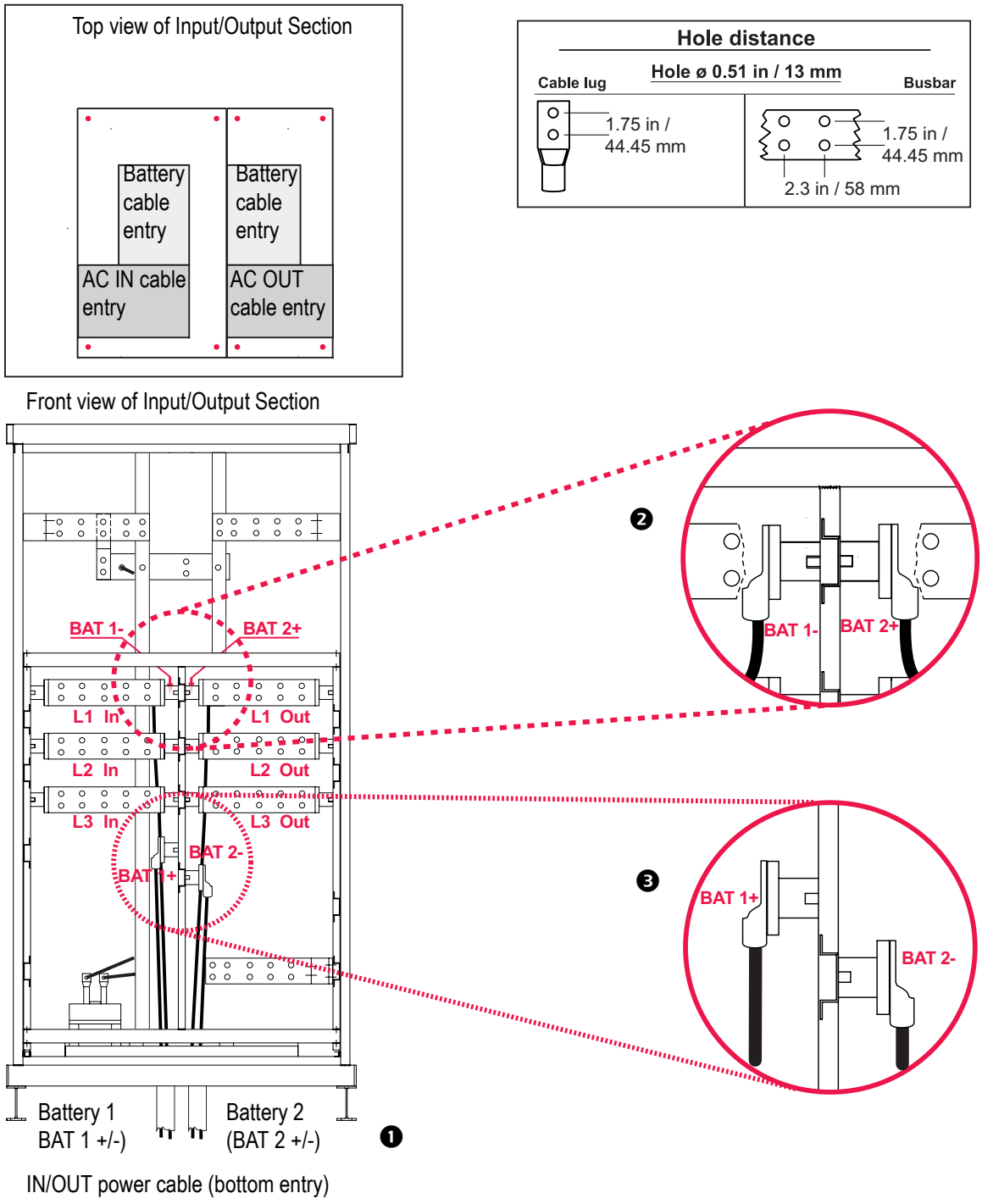
**WARNING!**
**Make sure that the battery breakers are open (OFF) prior to running the cables.**

**CAUTION!**
Refer to the battery manufacturer's installation manual.

**CAUTION!**
The minimum DC voltage rating of the battery supply over-current protective device is 500 V.

Over-current protection for the battery circuit is required by code.

BAT 1 and BAT 2 cables MUST be run in separate conduits.



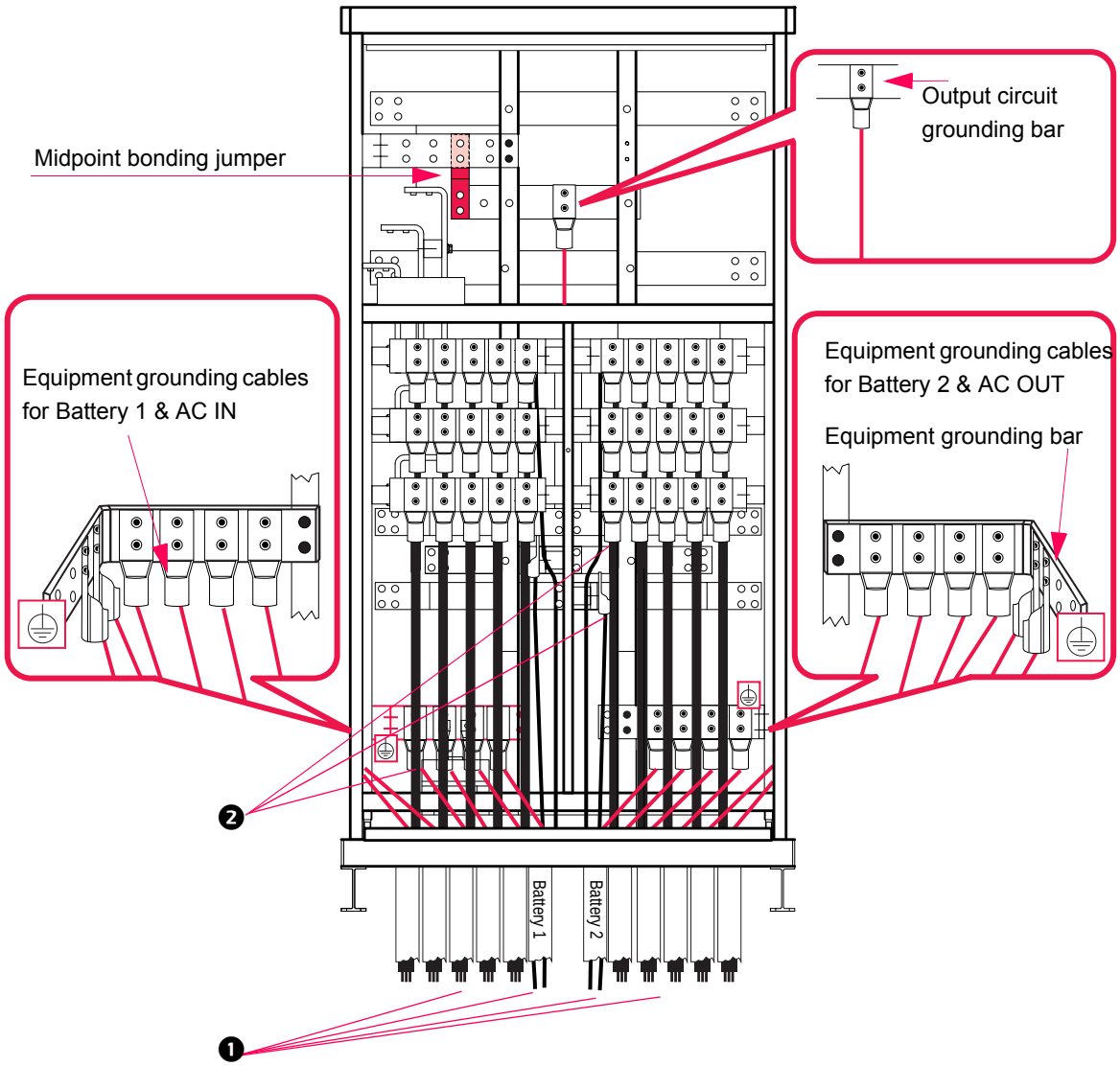

IN/OUT power cable (bottom entry)

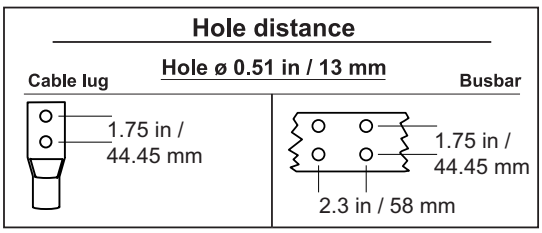
❶ Feed the battery cables through the bottom of Input/Output Section.

❷ Connect cables from battery system as illustrated.

❸ Connect cables from battery system as illustrated.

## Ground and AC cable connections (bottom cable entry)




❶ Feed the AC and ground cables through the bottom of Input/Output Section as illustrated.

❷ Connect cables as illustrated.

# Bypass Static Switch Wiring

**WARNING!**
**Use only manual reset protection as input over-current protection.**

**WARNING!**
**Over-current protection required by code.**

**WARNING!**
**The UPS has no internal manual disconnect devices to switch off external AC (Q1 and Q5) and DC (Q7 and Q8) input power. Ensure that disconnection devices are available as separate components for this installation.**

**CAUTION!**
The External Bypass Static Switch is not provided with built-in backfeed protection. The breaker is controlled from the External Bypass SSW and will be tripped in case of backfeed.

Note

The installer must provide each external disconnection device for this UPS system with labels displaying the following text:
“Isolate the Uninterruptible Power Supply (UPS) as instructed in the User Guide before working on circuit.”

Note

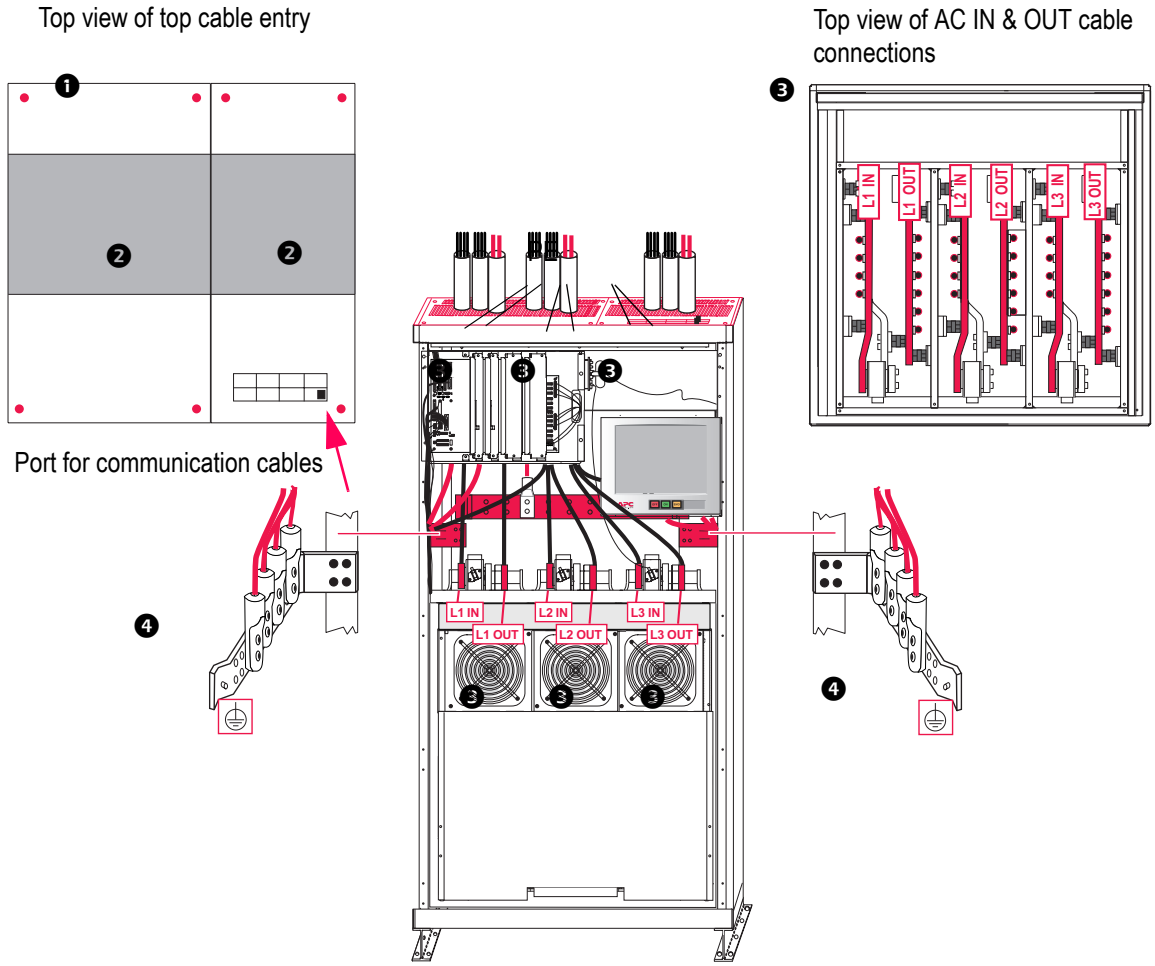
The installation of the External Bypass Static Switch must comply with local and national codes.

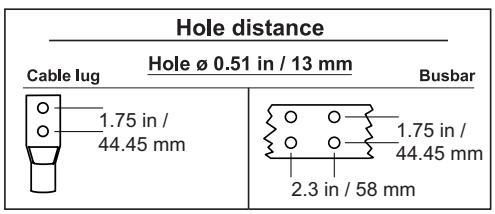
Note

Run matched set of phase cables in the same cable run(s).
Do not separate phases into different cable runs.

For information on cable lugs, cable ratings, over-current protection and the disconnection switches, refer to “Specifications” .

## Top cable entry




❶ Loosen the 8 bolts to remove top cover.

**Note**

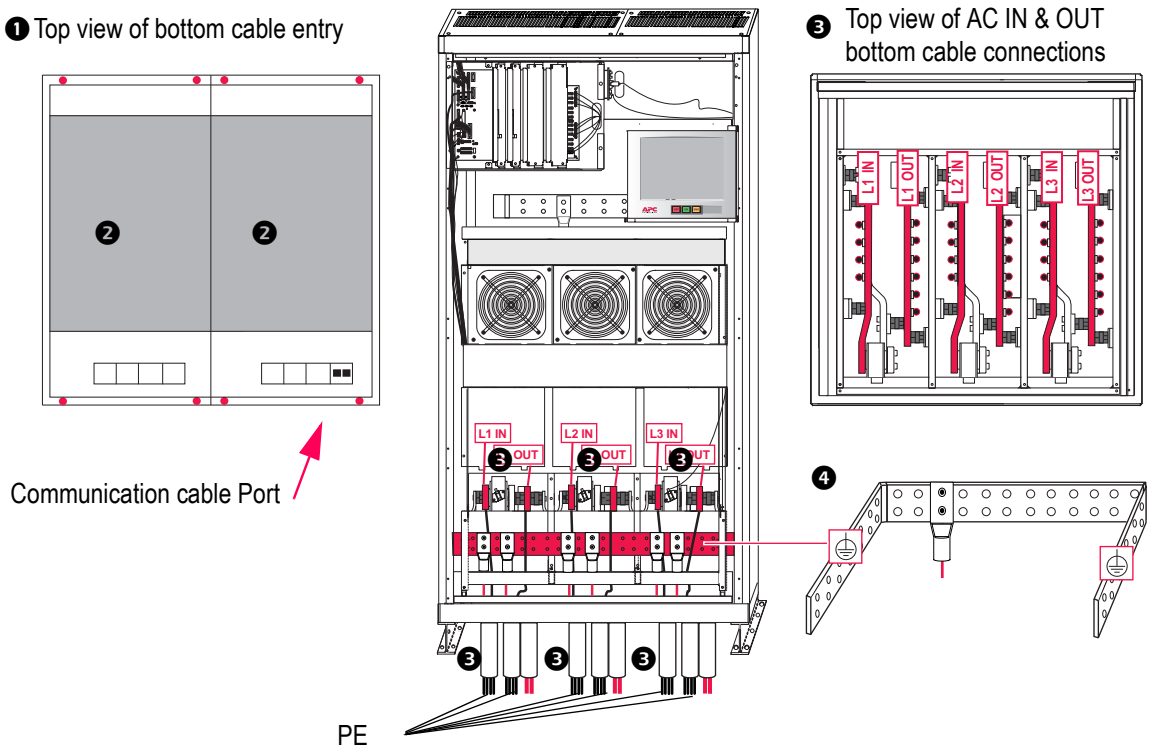
No drilling or cutting should take place over the top of the UPS.

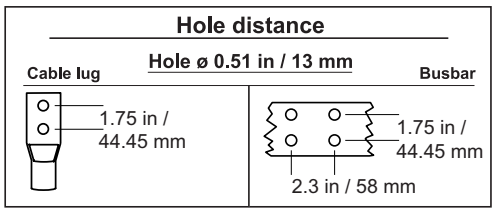
❷ Drill holes for conduits. Re-fit the covers. Install the conduits.

❸ Feed cables through conduits. Connect cables at cable connection points as illustrated.

❹ Connect grounding electrode conductor to busbar locations as shown.

## Bottom cable entry




❶ Loosen the 8 bolts to remove bottom cover.

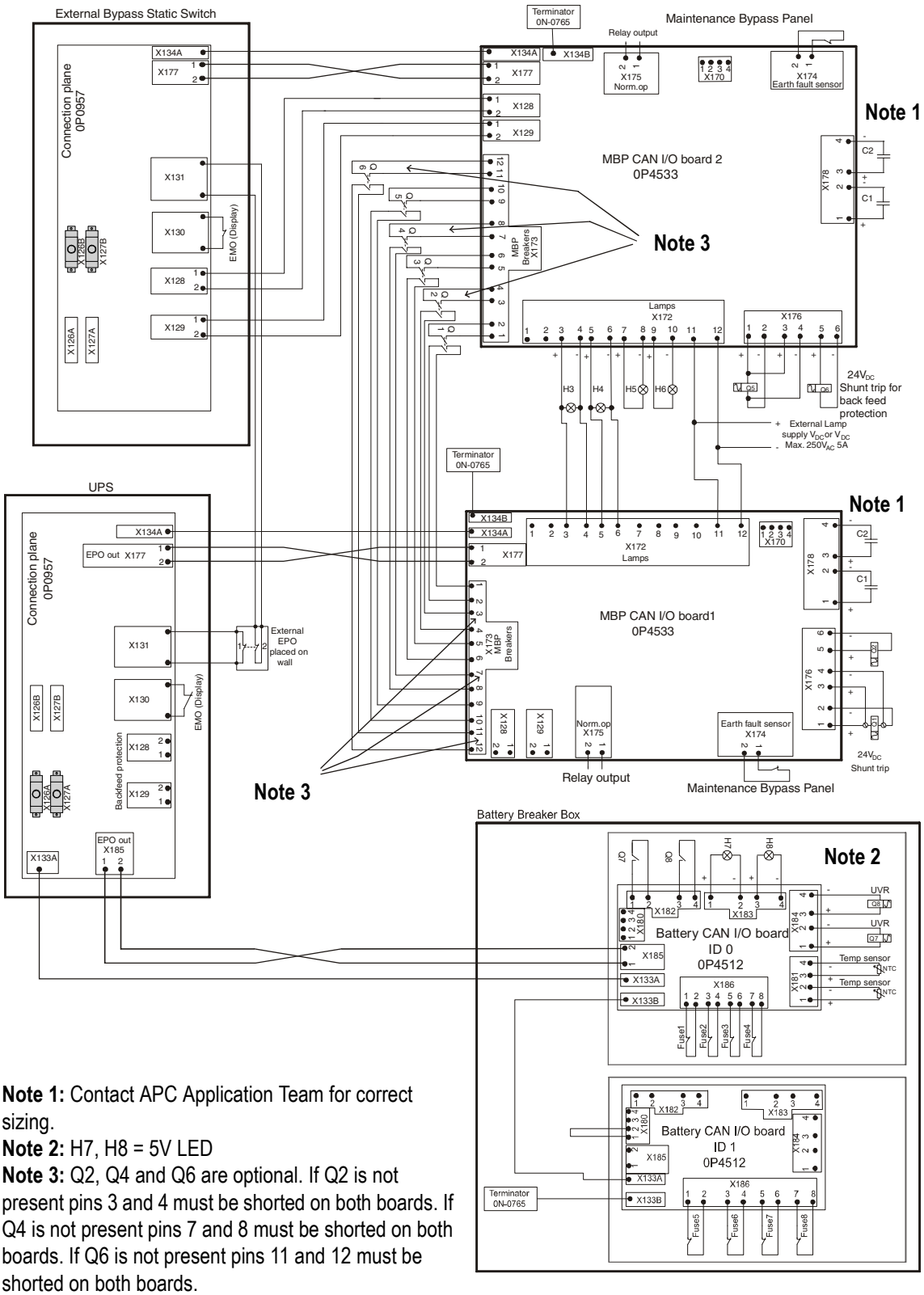
**Note** No drilling or cutting should take place inside the UPS.

❷ Drill holes for conduits. Re-fit the covers. Install the conduits.

❸ Feed cables through conduits. Connect cables at cable connection points as illustrated.

❹ Connect grounding electrode conductor to busbar locations as shown.

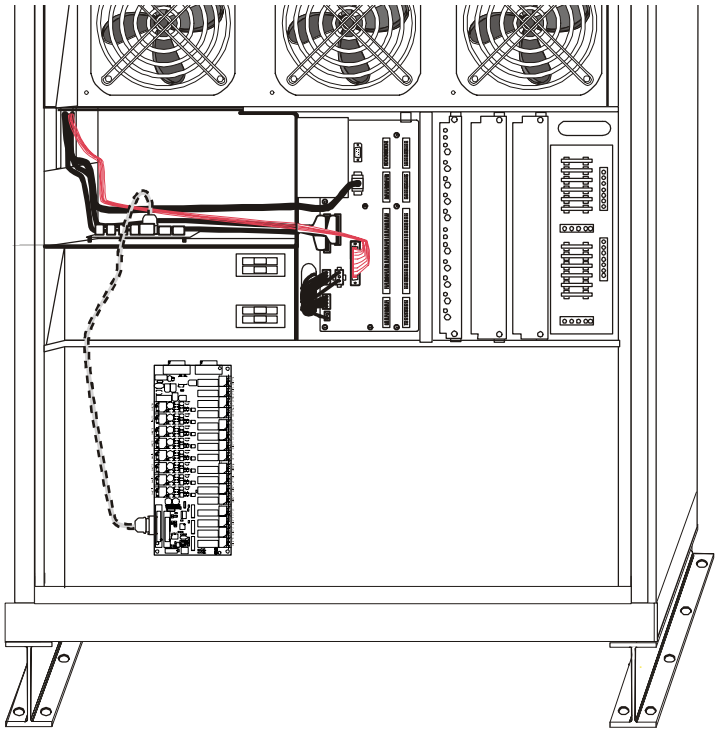
# Communication cable overview



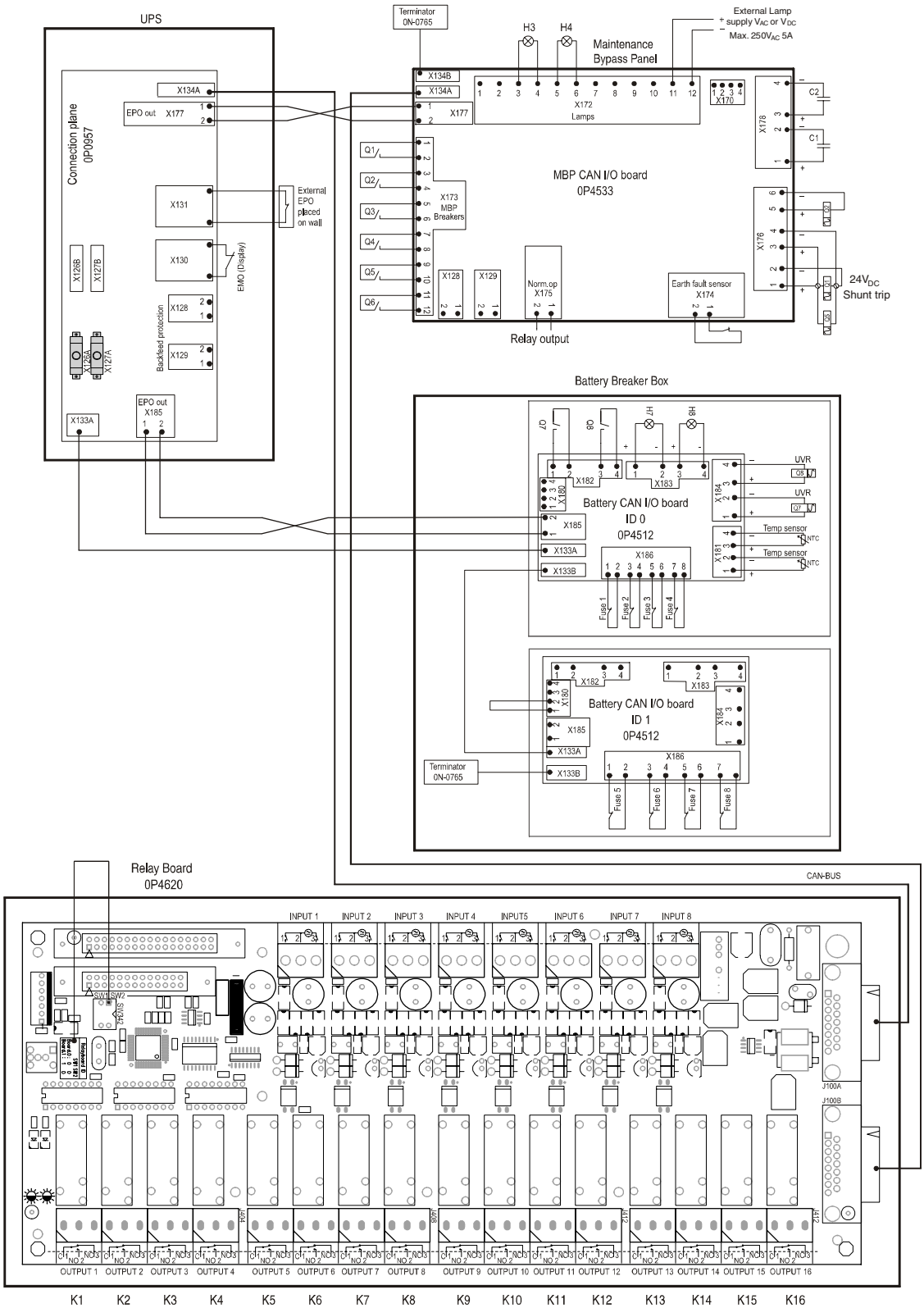

**Note 1:** Contact APC Application Team for correct sizing.
**Note 2:** H7, H8 = 5V LED
**Note 3:** Q2, Q4 and Q6 are optional. If Q2 is not present pins 3 and 4 must be shorted on both boards. If Q4 is not present pins 7 and 8 must be shorted on both boards. If Q6 is not present pins 11 and 12 must be shorted on both boards.

# Relay Board (Optional)

### Location of optional Relay Board



## Communication cables with optional Relay Board



## Relay Board functions

The Relay Board informs the user of the operation mode, status, and alarm conditionsand has 8 ports on the input side and 16 output terminals.

Note

Use Normally Closed (NC) contacts for Fail safe Mode and Normally Open (NO) for Active on.

| Relay ID | Name | Events that will trigger the alarm | Mode | Comment |
|---|---|---|---|---|
| K1 | Common Alarm | • Any of the functions below, except relays K8, K9, K10, K11;<br>• Inverter section fault;<br>• Main PSU fault;<br>• System locked in operation mode;<br>• Internal memory fault;<br>• Internal communication fault. | Fail safe | Warning |
| K2 | Battery voltage out of tolerance | • DC voltage is too high (shut down);<br>• DC voltage is under warning level;<br>• DC voltage is low (shut down). | Fail safe | Warning |
| K3 | Mains out of tolerance | • Mains voltage RMS value is out of tolerance;<br>• Mains waveform not accepted (fast detector);<br>• Mains frequency is out of tolerance. | Fail safe | Warning |
| K4 | Bypass out of tolerance | • Bypass voltage RMS value is out of tolerance;<br>• Bypass waveform not accepted (fast detector);<br>• Bypass frequency is out of tolerance. | Fail safe | Warning |
| K5 | Battery condition fault | • Battery monitor has detected a weak battery;<br>• Battery monitor has detected a defective battery. | Fail safe | Fault |
| K6 | Battery disconnected | • Battery breaker tripped/open. | Fail safe | Fault |
| K7 | System overload | • Output load exceeded 100%;<br>• Delta Inverter current limiter is active;<br>• Main Inverter current limiter is active. | Fail safe | Fault |
| K8 | Output out of tolerance | • Output voltage RMS value is out of tolerance;<br>• Output waveform not accepted (fast detector);<br>• Output frequency is out of tolerance. | Fail safe | Fault |
| K9 | Normal operation | • UPS is running in normal operation. | Active on | Opr. mode |
| K10 | Battery operation | • UPS is running in battery operation. | Active on | Opr. mode |

| Relay ID | Name | Events that will trigger the alarm | Mode | Comment |
|---|---|---|---|---|
| K11 | Bypass operation | • UPS is running in normal operation/ bypass operation according to AS400/ Novell. | Active on | Opr. mode |
| K12 | Maintenance bypass ON | • The maintenance bypass switch is active. | Active on | Opr. mode |
| K13 | Stand-by operation | • UPS is in stand-by operation. | Active on | Opr. mode |
| K14 | Boost charge operation | • UPS is boost charging the batteries. | Active on | Opr. mode |
| K15 | Fan fault | • Blocked or faulty fan. | Fail safe | Fault |
| K16 | High equipment temperature or inverter fuse blown | • Static Switch temperature is high;<br>• Main Inverter failure (high temperature or blown fuse);<br>• Delta Inverter temperature is high;<br>• Magnetics temperature is high;<br>• Isolation Transformer temperature is high (optional);<br>• Battery temperature is high. | Fail safe | Warning |
| IN1 | Generator active | • System on generator | | System is running on generator. Battery charging is derated. |
| IN2 | Battery room ventilation fault | • Battery room ventilation | | Ventilation fault in battery room. Battery charging is off. |
| IN3 - IN8 | Reserved for future use | | | |

# Specifications

## Low-Impedance/High-Impedance Grounding

The Symmetra® MW is easily integrated into either a low-impedance (solidly) grounded Wye system, or a high-impedance grounded system. In a low-impedance grounded system (most common), the power source (utility, generator, or UPS) is solidly grounded. In the event of a down-stream ground fault, the fault current will have a path back to the source, and the over-current device feeding the faulted part of the installation will trip and isolate the fault.

In a high-impedance grounded system, the source is grounded with an impedance (grounding resistor). In the event of a down-stream fault, the fault current will be limited by the impedance of the grounding resistor. The value of a high-impedance system is its ability to maintain operation with a given system fault to ground, i.e. the over-current device will only trip at line-to-line faults or double ground faults. For a high-impedance system to provide enhanced power system reliability and availability, a ground-fault monitoring/alarm system is required.

### Low-impedance grounding

For low-impedance grounding, verify the presence of the copper midpoint bonding jumper.

For location of the jumper, see “Ground and AC cable connection” in Installation Guide.

Connect the output circuit grounding electrode conductor to a grounding electrode in accordance with NEC 1999, article 250-26.

Grounding electrode conductor to be supplied by the customer.

### High-impedance grounding

For high-impedance grounding, remove the pre-installed copper midpoint bonding jumper.

For location of the jumper, see “Ground and AC cable connection” in Installation Guide.

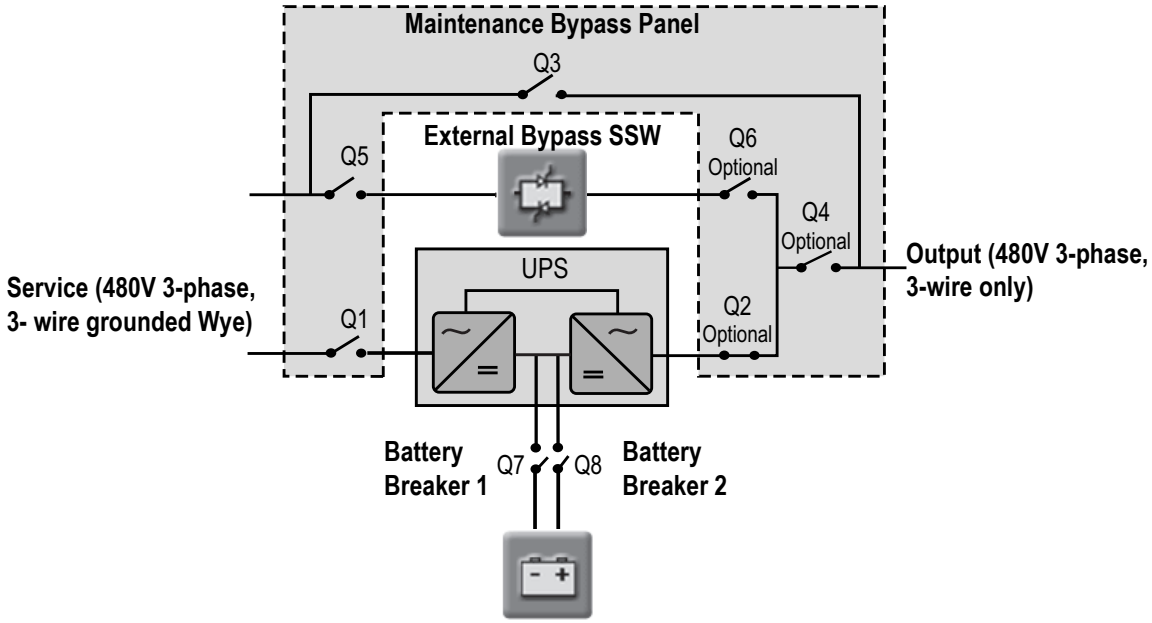
Install ground-fault detection circuit in accordance with NEC 1999, article 250-36.

For high-impedance grounding, the installation must include ground-fault detection circuitry.

From an external grounding resistor, and through a separate conduit, connect a cable to the output circuit grounding bar.

# Electrical Specification

## Installation Planning Data




Note

The installation is a typical installation including ancillary equipment, which is available from APC.

Note

UPS and External Bypass Static Switch feed must be generated from synchronized sources.

**WARNING!**
**Supply the UPS from a dedicated, grounded 3-wire Wye service.**

**WARNING!**
**The UPS has no internal manual disconnect devices to switch off external AC (Q1 and Q5) and DC (Q7 and Q8) input power. Ensure that disconnection devices are available as separate components for this installation.**

**CAUTION!**
Ensure clockwise phase rotation (L1, L2, L3) of input voltages.

**CAUTION!**
AC and DC disconnect switches and over-current protection must be included in the installation.

Note

All wiring must comply with all applicable national and/or local electrical codes.

Note

Max. prospective RMS short-circuit current on input terminals: 200 kA
Max. prospective RMS short-circuit current on battery terminals: 50 kA

## AC Input

**AC Input**

| | |
|---|---|
| Input Rating | 1000 kW/kVA |
| Power Factor | 1 |
| Input Voltage | 480 V |
| Input Frequency | 60 Hz |
| Nominal Input Current (note 1) | 1240 A |
| Maximum Input Current (note 2) | 1364 A |
| Input Current Limitation (note 3) | 1564 A |
| Recommended Cable per phase (notes 4, 6, 7, a, b, c) | 5 × 500 kcmil |

## DC Input

**DC Input**

| | |
|---|---|
| Nominal Voltage (note 5) | 2 x 384 V |
| $I_{Nom}$ Discharge (note 8) | 1356 A |
| $I_{Max}$ Discharge (note 9) | 1595 A |
| Recommended cable (per pole) | 5 × 500 kcmil |

**CAUTION!**
The minimum DC voltage rating of the battery supply over-current protective device is 500 V.

## AC Output

| AC Output | |
|---|---|
| Voltage | 480 V |
| Current Nom | 1203 A |
| Max (note 11) | 1504 A |
| Recommended cable (per phase) | 5 × 500 kcmil |

## AC Input External Bypass SSW

The External Bypass SSW is designed to accommodate a continuous overload of 25%.

| AC Input External Bypass SSW | |
|---|---|
| External Bypass SSW Max Input Current (100% load) | 1203 A |

## Heat Dissipation

105.5 kBTU/hr (note 10)

## Notes

1. Nominal (Nom): Input current based on rated load.
2. Maximum (Max): Input current based on full battery recharge + nominal input voltage + rated load.
3. Current limitation (A) through electronic current limiting is based on full battery recharge + nominal load and -15% input voltage (see “Required Breaker Settings” ).
4. Input, Output and Battery1 and Battery2 circuit cables shall be run in separate conduits or raceways. Cables shall be rated at 600 V as a minimum.
5. Nominal battery voltage at 2.0 volts/cell.
6. Recommendation: All cables shall be sized in accordance with 2002 NEC 210-19 FPN No. 4 branch feeder voltage drop of 3%. Voltage drop not considered in above chart. Application-specific Input Cable Ampacity may vary from above chart.
7. Equipment Grounding Conductors shall be sized in accordance with Table 250-122 of the 2002 NEC and shall be installed in accordance with Article 250 Section VI and Section VII of the 2002 NEC. Grounding Electrode Conductors shall be sized in accordance with Article 250.66 and Table 250.66 of the 2002 NEC and should be installed in accordance with Article 250

Section III of the 2002 NEC.

8. Nominal Battery Discharge current based on rated load, and nominal battery voltage.
9. Maximum Battery Discharge current based on rated load at end of discharge.
10. Heat dissipation calculated at rated load capacity.
11. This current is at 125% of rated load and is electronically current-limited to a maximum of 10 minutes. This value is only provided so the engineer can ensure that the selected AC output circuit over-current device's time-current characteristic will support this condition.
    a. Temperature rating of conductors: 194$^{o}$F (90$^{o}$C). Reference: Table 310-16 of NEC, 75$^{o}$C column. Use only copper conductors. 167$^{o}$F (75$^{o}$C) cable terminal connectors assumed.
    b. Reference: NEC Handbook 2002. Consult local codes for possible variations.
    c. All cable ratings are supplied as guidelines only. These guidelines are recommendations only, and should not be considered substitutes for review and compliance with NEC, national, or local codes. Consult with your licensed engineer for site-specific applications. 86$^{o}$F (30$^{o}$C) assumed. Over-current protection provided by others.

### *Table 2 - Table 310-16 (National Electrical Code)*

National Electrical Code and NEC are registered trademarks of the National Fire Protection Association, Quincy, MA.

Allowable Ampacities of Insulated Conductors rated 0 Through 2000 Volts, 60$^{o}$C Through to 90$^{o}$C (140$^{o}$F Through 194$^{o}$F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30$^{o}$C (86$^{o}$F).

| Size | Temperature Rating of Cables (See Table 310-13) | | | | | | Size |
|---|---|---|---|---|---|---|---|
| AWG or kcmil | 60°C (140°F) | 75°C (167°F) | 90°C (194°F) | 60°C (140°F) | 75°C (167°F) | 90°C (194°F) | AWG or kcmil |
| | Types TW,UF | Types FEPW,RH,RHW,THHW, THW,THWN, XHHW, USE,ZW | Types TBS,SA,SIS,FEP, FEPB,MI,RHH, RHW-2,THHN, THHW,THW-2, THWN-2,USE-2, XHH,XHHW,XHHW-2,ZW-2 | Types TW,UF | Types RH,RHW,THHW,THW, THWN, XHHW,USE | Types TBS,SA,SIS,THHN,THHW,THW-2,THWN-2, RHH,RHW-2, USE-2,XHH, XHHW, XHHW-2,ZW-2 | |
| | Copper | | | Aluminium or Copper-Clad Aluminium | | | |
| 18 | - | - | 14 | - | - | - | - |
| 16 | - | - | 18 | - | - | - | - |
| 14* | 20 | 20 | 25 | - | - | - | - |
| 12* | 25 | 25 | 30 | 20 | 20 | 25 | 12* |
| 10* | 30 | 35 | 40 | 25 | 30 | 35 | 10* |
| 8 | 40 | 50 | 55 | 30 | 40 | 45 | 8 |
| 6 | 55 | 65 | 75 | 40 | 50 | 60 | 6 |
| 4 | 70 | 85 | 95 | 55 | 65 | 75 | 4 |
| 3 | 85 | 100 | 110 | 65 | 75 | 85 | 3 |
| 2 | 95 | 115 | 130 | 75 | 90 | 100 | 2 |
| 1 | 110 | 130 | 150 | 85 | 100 | 115 | 1 |
| 1/0 | 125 | 150 | 170 | 100 | 120 | 135 | 1/0 |
| 2/0 | 145 | 175 | 195 | 115 | 135 | 150 | 2/0 |
| 3/0 | 165 | 200 | 225 | 130 | 155 | 175 | 3/0 |
| 4/0 | 195 | 230 | 260 | 150 | 180 | 205 | 4/0 |
| 250 | 215 | 255 | 290 | 170 | 205 | 230 | 250 |
| 300 | 240 | 285 | 320 | 190 | 230 | 255 | 300 |
| 350 | 260 | 310 | 350 | 210 | 250 | 280 | 350 |
| 400 | 280 | 335 | 380 | 225 | 270 | 305 | 400 |
| 500 | 320 | 380 | 430 | 260 | 310 | 350 | 500 |
| 600 | 355 | 420 | 475 | 285 | 340 | 385 | 600 |
| 700 | 285 | 460 | 520 | 310 | 375 | 420 | 700 |
| 750 | 400 | 475 | 535 | 320 | 385 | 435 | 750 |
| 800 | 410 | 490 | 555 | 330 | 395 | 450 | 800 |
| 900 | 435 | 520 | 585 | 355 | 425 | 480 | 900 |
| 1000 | 455 | 545 | 615 | 375 | 445 | 500 | 1000 |
| 1250 | 495 | 590 | 665 | 405 | 485 | 545 | 1250 |
| 1500 | 520 | 625 | 705 | 435 | 520 | 585 | 1500 |
| 1750 | 545 | 650 | 735 | 455 | 545 | 615 | 1750 |
| 2000 | 560 | 665 | 750 | 470 | 560 | 630 | 2000 |
| **CORRECTION FACTORS** | | | | | | | |
| **Ambient Temp. (°C)** | **For ambient temperatures other than 30°C (86°F), multiply the allowable Ampacities shown above by the appropriate factor shown below** | | | | | | **Ambient Temp. (°F)** |
| 21-25 | 1.08 | 1.05 | 1.04 | 1.08 | 1.05 | 1.04 | 70-77 |
| 26-30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 78-86 |
| 31-35 | 0.91 | 0.94 | 0.96 | 0.91 | 0.94 | 0.96 | 87-95 |
| 36-40 | 0.82 | 0.88 | 0.91 | 0.82 | 0.88 | 0.91 | 96-104 |
| 41-45 | 0.71 | 0.82 | 0.87 | 0.71 | 0.82 | 0.87 | 105-113 |
| 46-50 | 0.58 | 0.75 | 0.82 | 0.58 | 0.75 | 0.82 | 114-122 |
| 51-55 | 0.41 | 0.67 | 0.76 | 0.41 | 0.67 | 0.76 | 123-131 |
| 56-60 | - | 0.58 | 0.71 | - | 0.58 | 0.71 | 132-140 |
| 61-70 | - | 0.33 | 0.58 | - | 0.33 | 0.58 | 141-158 |
| 71-80 | - | - | 0.41 | - | - | 0.41 | 159-176 |

**Reprinted with permission from NFPA 70-2005, National Electrical Code®, Copyright © 2004, National Fire Protection Association, Quincy, MA 02169. This reprinted material is not the complete and official position of the NFPA on the referenced subject, which is represented only by the standard in its entirety.**

### Recommended cable, bolt, and lug sizes

| Cable Size | Bolt hole size | Hole spacing | Lug width | Lug P/N (1)(2) | Crimping Tool and Dies |
|---|---|---|---|---|---|
| 400 kcmil | 0.5 in/12.7 mm | 1.75 in/44.45 mm | 1.39 in/35.31 mm | Panduit LCD400-12-6 (or equivalent) | Manufacturer recommended crimping tool and dies. |
| 500 kcmil | 0.5 in/12.7 mm | 1.75 in/44.45 mm | 1.54 in/39.12 mm | Panduit LCD500-12-6 (or equivalent) | Manufacturer recommended crimping tool and dies. |
| 600 kcmil | 0.5 in/12.7 mm | 1.75 in/44.45 mm | 1.70 in/43.18 mm | Panduit LCD600-12-6 (or equivalent) | Manufacturer recommended crimping tool and dies. |

Cable lugs are not supplied.

### Torque specifications

| Torque specifications | |
|---|---|
| Bolt Size M8 | 10 lbf-ft/13.5 Nm |
| Bolt Size M10 | 22 lbf-ft/30 Nm |
| Bolt Size M12 | 37 lbf-ft/50 Nm |
| Bolt Size M14 | 55 lbf-ft/75 Nm |

# Required Breaker Settings

The Symmetra® MW is a fault-tolerant system capable of handling and surviving overloads and internal/external faults. The overload performances and fault clearings are possible when the system meets specified minimum requirements for breaker settings. The settings are specified in the tables below, but some of them can also be found in the Electrical Specification section. The settings are all minimum settings and may not result in a drop-out.

See also

See separate guide on parallel operation for information on required breaker settings in parallel systems.

### Input and upstream breakers — minimum settings

| Q1, Q5, and any upstream breaker | | | |
|---|---|---|---|
| **Duration [S]** | **Current [A]** | **Total load [%]** | **Event/Operation** |
| ≤ 0.005 | 18 kA | -- | Internal fault clearing |
| ∞ | 1880* | 130 | Overload on-line |
| ∞ | 1245 | 100 | On-line |
| ∞ | 1370 | 110 | On-line + Max. Battery Charge |
| *** Only applicable to Q1** | | | |

### Output and downstream breakers — minimum settings

| Q2, Q4, Q6, and any downstream breaker | | | |
|---|---|---|---|
| **Duration [S]** | **Current [A]** | **Total load [%]** | **Event/Operation** |
| ≤ 0.005 | 18 kA | -- | Internal fault clearing. |
| 60 | 2406* | 200 | Overload on-line |
| 600 | 1504* | 125 | Overload on-line |
| ∞ | 1203 | 100 | On-line |
| *** Only applicable to Q2 and Q4** | | | |

18 kA is the maximum peak let-through current (including safety factor) available during clearing of an internal fault in a 200 kW section or a Power Module. During or after a controlled fault clearing, none of the breakers are allowed to trip on the instantaneous trip setting below the specified value. This is also applicable to the upstream breakers, and a control of the instantaneous trip setting in this part of the installation is required. The maximum peak let-through current is applicable to utility with prospective short-circuit currents up to 200 kA.

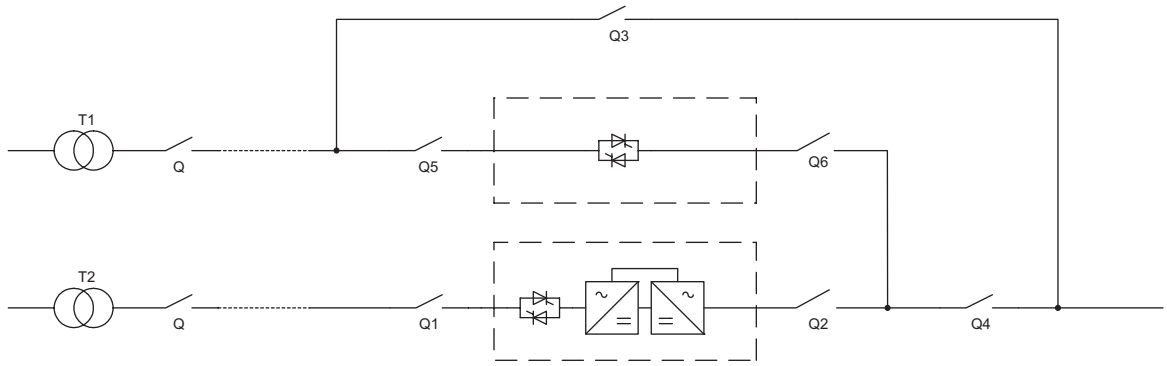
**Note** The instantaneous trip setting must not be derated even though the UPS system is derated in system output power. The system size has no influence on the instantaneous trip setting.

**Note** For derated systems, the APC Application Team provides the correct breaker settings and breaker frame sizes.

**Note** For upstream breakers not mentioned in the table, the APC Application Team provides the correct breaker settings for on-line, overload, and trip currents.

The following diagram shows a dual utility system in which the upstream breakers are named Q. Correct settings of upstream breaker settings are mandatory. The system can also be configured as a single utility system.

Dual Utility Installation



# General Specifications 480 V

| | |
|---|---|
| Backfeed protection | Built-in in the UPS |
| Humidity | Max. 95% non-condensing |
| Protection class | NEMA 1 |
| Safety | UL 1778 listed |
| Emission and immunity | FCC part 15, sub part J Class A (conducted/radiated) |

# APC Worldwide Customer Support

Customer support for this or any other APC product is available at no charge in any of the following ways:

- Visit the APC Web site to access documents in the APC Knowledge Base and to submit customer support requests.
  - **www.apc.com** (Corporate Headquarters)
    Connect to localized APC Web sites for specific countries, each of which provides customer support information.
  - **www.apc.com/support/**
    Global support searching APC Knowledge Base and using e-support.
- Contact an APC Customer Support center by telephone or e-mail.
  - Regional centers

| | |
|---|---|
| Direct InfraStruXure Customer Support Line | (1)(877)537-0607 (toll free) |
| APC headquarters U.S., Canada | (1)(800)800-4272 (toll free) |
| Latin America | (1)(401)789-5735 (USA) |
| Europe, Middle East, Africa | (353)(91)702000 (Ireland) |
| Japan | (0) 35434-2021 |
| Australia, New Zealand, South Pacific area | (61) (2) 9955 9366 (Australia) |

  - Local, country-specific centers: go to **www.apc.com/support/contact** for contact information.

Contact the APC representative or other distributor from whom you purchased your APC product for information on how to obtain local customer support.

Entire contents copyright 2007 American Power Conversion Corporation. All rights reserved. Reproduction in whole or in part without permission is prohibited. APC, the APC logo, and Symmetra are trademarks of American Power Conversion Corporation. All other trademarks, product names, and corporate names are the property of their respective owners and are used for informational purposes only.

990-4112E 02/2007